

COLOR CHANGES BY ADULTS OF THE TORTOISE
BEETLE, *PHYSONOTA HELIANTHI* (RANDALL)
(COLEOPTERA: CHRYSOMELIDAE)

VERNON M. KIRK

Entomology Research Division, Agr. Res. Serv., USDA,
Brookings, South Dakota 57006

ABSTRACT

Previously the number of generations per year and adult coloration of *Physonota helianthi* (Randall) have been recorded erroneously or incompletely. It is univoltine in South Dakota and overwinters as an adult. It goes through 3 color changes: 1) dingy white (teneral adult), 2) black-and-white (intermediate phase of about 3 weeks), and 3) iridescent green (mature adult). The intermediate phase appeared to be correlated with feeding on the host (normally *Helianthus grosseserratus* Martens) rather than surroundings or disturbance.

Taxonomically, the identity of *Physonota helianthi* (Randall) seems to have been settled, but there is erroneous or incomplete information regarding the number of generations, the color of specimens, and the number of spots on the pronotum. Thus, Randall (1838) described living specimens as "blackish, irregularly spotted with white," having 3 black spots on the pronotum, and feeding on a species of wild sunflower (*Helianthus* sp.). From what appear to have been cabinet specimens, Walsh (1869) described another species (*P. quinquepunctata*) as also feeding on *Helianthus*; this insect was "more or less pale dull olive color, dotted with pale yellow," with 5 spots on the pronotum, 3 of which were black, and 2 dark olive spots sometimes confluent. However, Caulfield (1886) noted that 2 olive spots appeared to be the only difference between the 2 species. He also observed that these 2 spots fade soon after death and become almost imperceptible in old museum specimens, while the 3 posterior spots retain their color. He therefore synonymized *P. quinquepunctata* under *P. helianthi*. This opinion was confirmed by Sanderson (1948), who also worked with museum specimens; he referred to the elytra as being "usually distinctly mottled with creamy yellow spots."

Caulfield (1884) additionally reported that *P. helianthi* is "double-brooded in Montreal, occurring in June and again in August, but the broods when living present a very different appearance. The beetles of the first brood are entirely of a burnished gold color, and are exceedingly beautiful. The fall brood show no trace of gold and answer Randall's description, except that I would call them blackish green. . . . with yellowish white spots. After death both broods fade to a dingy yellow, and are exactly alike." After further study, Caulfield (1886) concluded that *P. helianthi* may possess the power of assuming different tints as is the case with some other species of the family. He observed that all adults from field-collected larvae were pure black and white when living but faded soon after death. He did not say how long these adults lived.

During 1967, 1968, and 1969, *P. helianthi* was the major insect pest of the wild sunflower (*Helianthus grosseserratus* Martens) in eastern South Dakota. Both adults and larvae fed on the underside of the leaves and occasionally defoliated the plants.

I found adults laying eggs on this host in late June of each of the 3 years. They were iridescent green with a tint of gold, and the pronotum of each had both the 3 black spots described by Sanderson (1948) and the 2 nearly confluent spots described by Walsh (1869). However, the confluent spots had dark green centers surrounded by a faint light green ring. The green color of these overwintered insects faded within a month after specimens had been killed, and they became a dull gold with a faint cast of green.

By August, no green (overwintered) adults could be found, and teneral adults of the new generation were appearing on the plants. The elytra of the young adults were black with a white margin and were distinctly mottled with white by the third day after emergence. The pronotum was white with 5 black spots; on some specimens, the 2 anterior spots were as black as the other 3, but on most, they were merely transparent areas that appeared dark because of depth, without pigmentation.

The black-and-white coloring also changed within a month after adults of the new generation were killed and pinned. The mottled spots and the margin were still visible but were dull gold; the previously black areas assumed an olive-green cast beneath the dull gold. On the pronotum, the 3 posterior spots remained black and the 2 anterior spots faded to gray on most beetles, though they remained black on others.

The black-and-white color phase proved to be merely an intermediate one between the dingy-white or ivory of the teneral adult and the iridescent green of the mature adult. About half the beetles found during the last week of August were either iridescent green or some intermediate shade between black-and-white and green; the other beetles were still black-and-white. Several black-and-white adults, given *H. grosseserratus* leaves to eat in the laboratory, turned green by the end of the third week.

Although Caulfield (1884) could see no difference between the color phases several weeks after death, I found them to be easily distinguishable. The elytral mottling of specimens that had been labeled black-and-white was obvious, even after 2 years in the collection cabinet, and the previously black areas were a definite olive-green beneath a dull gold. The specimens that had been green when alive were dull gold with a very faint green cast.

I found no evidence that the adults are able to change their hue or brilliance according to their surroundings or from being disturbed, as do some species in this subfamily. However, it was possible that the color changes observed in *P. helianthi* might be associated with food. Prokop (1969) found this true of the eastern hercules beetle, *Dynastes tityus* (L.). Mature specimens of *P. helianthi* were given leaves of *H. grosseserratus* to eat in the laboratory from 8 September to 10 October 1968, then they were put in a container of damp peat moss and kept at 4°C. Several specimens had partially reverted to the black-and-white coloration by 12 February 1969, and all were dead by 30 March, probably because they had used up their food reserves. I have seen 2 or 3 specimens in the field that were intermediate color phases in early June, long before any eggs or larvae could be found on the host plants. It therefore appears that at least some of the beetles overwintering in natural sites revert toward the black-and-white phase.

In South Dakota, *P. helianthi* is univoltine, and I believe it must be throughout its range in northern United States and Canada. I found no evidence of a second brood or generation. Larvae were present from late

June to early September, but they all appeared to be progeny of the overwintered beetles. I found adults ovipositing between late June and late July, but none were seen ovipositing after 1 August. Furthermore, no newly laid egg masses were found later in the summer, indicating that the new generation was not reproductively active until the following summer. The dates given for the "spring brood" (June) in Montreal (Caulfield 1884) agree with the time of appearance of the overwintered adults in South Dakota, and the adults of the "fall brood" (August) agree with the appearance of the first young adults in South Dakota.

ACKNOWLEDGMENTS

I would like to thank Charles A. Taylor, Botanist at South Dakota State University, for identifying the host plant; Edward U. Balsbaugh, Jr., Entomologist at SDSU, for identifying the insect; and Gerald R. Sutter, Entomologist, USDA, for taking the photograph (Fig. 1).

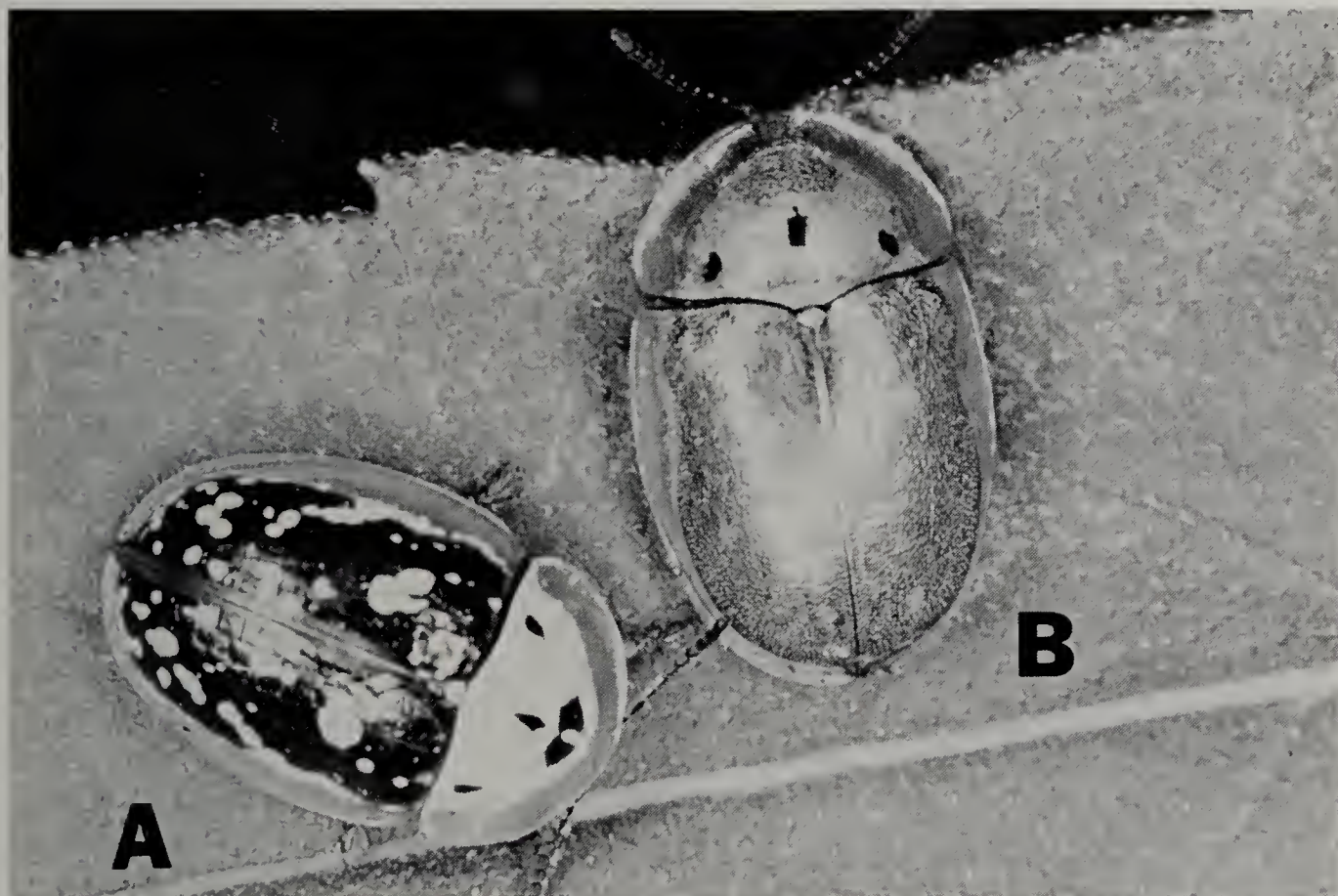


Fig. 1. (A) Intermediate (black-and-white) stage of *Physonota helianthi* between teneral and mature adult; (B) mature adult.

LITERATURE CITED

- CAULFIELD, F. B. 1884. Remarks on *Chrysomela scalaris* LeC., *Chrysomela labyrinthica* LeC., and *Physonota unipunctata* Say. Canadian Ent. 16:226-227.
- CAULFIELD, F. B. 1886. On *Physonota unipuncta* [sic] Say, and its supposed varieties. Canadian Ent. 18:41-45.
- PROKOP, M. E. 1969. Longevity and color change in the rhinoceros beetle, *Dynastes tityus* L. (Coleoptera:Scarabaeidae). Coleopt. Bull. 23:20-22.
- RANDALL, J. W. 1838. Description of new species of coleopterous insects inhabiting the state of Maine. Boston J. Nat. Hist. 2:1-33.
- SANDERSON, M. W. 1948. Larval, pupal and adult stages of North American *Physonota* (Chrysomelidae). Ann. Ent. Soc. Amer. 41:468-477.
- WALSH, B. D. 1869. Insects infesting the sweetpotato. Amer. Ent. 1:234-238.